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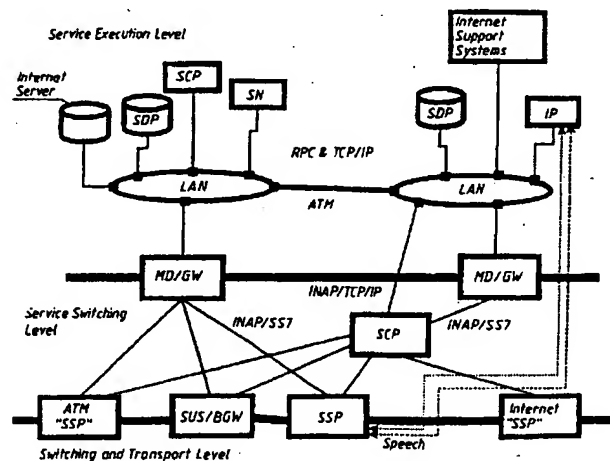
(57) Abstract

   A telecommunications system, has an intelligent network architecture and includes service data points, service control points, and a plurality of service switching points. Functional entities, e.g. Internet servers, service data points, service control points, service nodes, intelligent peripherals, and Internet support systems control the execution of telecommunications services and are linked by a data transmission network, capable of operating independently of the main telecommunications traffic network. The telecommunications system is arranged in three hierarchical levels, namely: a service execution level; a service switching level; and a switching and transport level. The data transmission network may include several LANs, to which the functional entities used to execute telecommunications services are connected.

## Improvements In, or Relating to
## Intelligent Network Architectures

The present invention relates to an intelligent network architecture for telecommunications systems, in particular, an intelligent network architecture including a service execution level, a service switching level and a switching and transport level, and in which service provision and control are independent of the telecommunications transport and switching medium.

With electromechanical switching systems, the introduction of new services, such as subscriber trunk dialling, requires the design of new hardware and modification of all exchanges in the system. This is costly and disruptive. Stored Program Control exchanges were introduced to facilitate the introduction of new services by modifying call-processing programs in the exchanges. It was initially thought that this would be an easy and cheap method of updating exchanges with new services. In practice, however, it has been found that making consistent software upgrades to many interconnected exchanges in a network is as costly and time-consuming as the hardware changes required with electromechanical exchanges. Consequently, such changes are made very infrequently and the introduction of new services is still a slow process. One way in which this problem can be overcome is to separate the software that controls basic functions, such as setting up and supervising connections, from the software required for providing more complex services. These include, for example, freephone service, calling-card service and value-added services.

The more complex services can be controlled by a centralized processor, called a service control point (SCP), which is remote from the exchange setting up the connection. A telecommunications network that has been enhanced in this way is called an intelligent network (IN). The exchange, or switching node, that makes the required connection is called a service switching point (SSP). In the AT&T network it is called an action control point (ACP).

The SSP communicates with its controlling SCP via a common-channel

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signalling network. The architecture of a known IN is shown in Figure 1. The SSP may be at any level in the network hierarchy (e.g. a local exchange, a trunk exchange, or an exchange in a special overlay network). Its software is modified so that a number of events can trigger it to suspend normal call processing and request the intervention of the SCP. These events may be the caller's class of service, the code digits dialled, or some subsequent event (e.g. ring tone no reply). As a result of the event, the SSP sends information to the SCP and resumes call processing when it receives back information on how to proceed.

The SCP is a centralized processor with access to a large database. Its software is organized in three levels:

- node software which provides common utilities, such as signalling, database access, transaction monitoring and alarm reporting;

- service logic programs (SLP) which are the programs that control the various services and are constructed, as far as possible, from modules, known as service-independent building blocks (SIB), which correspond to frequently used functions, such as: translate, verify, compare, charge and queue;

- the service logic execution environment (SLEE) which is the program-execution environment that hosts the various SLPs and interworks with the basic call-control and switching operations of the SSP.

Other specialized functions required for IN services are provided by intelligent peripherals (IP). Examples are digit-collection units and voice-guidance systems which give instructions to users by means of recorded announcements. These are associated with SSPs, but they can be controlled by the SCP via common-channel signalling. The common-channel signalling network is the means by which messages are passed between the SCP and SSPs and IPs. The signalling is non-associated because, usually, the SSP interacts with the SCP before the route is selected for a call. Thus, messages between the SSP and SSC

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pass through signal-transfer points. This requires the use of a modified version of the basic CCITT common-channel signalling system No.7. The signalling-connection control part (SCCP) and transaction capabilities (TC) have been added. The TC is a message structure designed specifically for the query and response messages used for IN transactions and the SCCP provides the information for routing these messages.

In a network with a number of SCPs, there may also be a service management system (SMS), connected to all the SCPs by data links. This manages the addition of new customers, updates of data (from the network operator, or customers) and data reloads (if an SCP crashes). Several telecommunication network operators have installed IN equipment, an example is the British Telecom digital derived services network (DDSN). This is an overlay and contains digital derived services switching centres (DDSSC), which are connected to trunk exchanges (DMSU). The DDSCs perform the SCP function and network control points (NCP) perform the SCP function. BT's DDSN network caters for freephone numbers for which call charges are levied against the called customer instead of the caller. Use of an IN enhances the freephone service in several ways. For example, if the organization being called has several offices, the call can be routed to whichever is nearest to the caller. However, outside of normal working hours all calls can be routed to a single office and this can be changed from day-to-day. Voice guidance can be used to enable a caller to choose between different departments of the organization being called. The network also caters for premium-rate calls to service providers, such as information services and the cellular radio networks. In this case, the caller pays at a higher rate than normal and the income from these calls is shared between network operator and the service provider. At present, intelligent networks use a centralized structure. However, IN-based services may be decentralised, with the SLEE, SLP and database located at local, or trunk, switching centres rather than at a remote SCP. This gives faster response times, reduces the load on the common-channel signalling network, and may be cheaper for widely used services.

As the number and complexity of services provided by telecommunications networks grows, the processing load carried by service control points becomes ever

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greater. This is compounded by the ever growing number of subscribers who wish to use advanced telecommunications services. The more centralised IN architectures cannot cope with these high service demands. To overcome this problem it is necessary to move towards a network architecture in which intelligence is distributed. The present invention relates to such an architecture, which, it is believed, has significant advantages over known architectures, such as the BT architecture described above.

As described above, it is known to use a modular construction for the service programs in an intelligent network using modules known as SIBs. However, SIBs represent very basic building blocks from which advanced telecommunications services can be constructed. In modern telecommunications systems, the services offered to subscribers are often complex, being made up of a range of different elementary services assembled to provide particular composite service provisions which are specific to only a few subscribers. In some cases, a service profile may be unique to a single subscriber. This creates a problem with service diversity. It is not economically possible for a network operator to provide an IP for each service provided. Such a strategy would, in extreme cases, result in the number of IPs employed in an intelligent telecommunications network exceeding the number of subscribers. There would, of course, be substantial duplication between the service functions provided by the different IPs.

According to a first aspect of the present invention, there is provided a telecommunications system, having an intelligent network architecture and including at least one service data point, at least one service control point, a plurality of service switching points, and a telecommunications traffic network, characterised in that functional entities, controlling execution of telecommunications services, are linked by a data transmission network, capable of operating independently of said telecommunications traffic network.

Preferably, said telecommunications system is arranged in three hierarchical levels, namely:

-        a service execution level;

-       a service switching level; and

-       a switching and transport level.

Said data transmission network may include at least one LAN, to which a plurality of said functional entities are connected.

Said data transmission network may include at least two LANS, to each of which is connected a plurality of functional entities, and said at least two LANS may be interconnected by means of an ATM link over which data is passed in RCP and TCP/IP format.

Said LAN(s) and the functional entities connected thereto may form a service execution level.

Said functional entities may include one, or more, of the following:

-       Internet servers;

-       service data points;

-       service control points;

-       service nodes;

-       intelligent peripherals; and

-       Internet support systems.

Said switching and transport level may include one, or more, of the following switching entities:

-       a SUS;

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- a SSP;

- an ATM SSP; and

- an Internet SSP.

Said service switching level may include one, or more SCPs.

Said service execution layer may be connected to said switching and transport level by means of an INAP/TCP/IP link between said data transmission network and an SCP in said service switching level, and said SCP in said service switching level may be directly linked to switching entities in said switching and transport level.

Gateway means may be provided to link functional entities, including SCPs, in said service execution level, to switching entities in said switching and transport level.

SCPs in said service switching level may be linked to functional entities in said service execution level via a gateway means, and may, in addition, be linked directly to said data transmission network.

IPs in said service execution level may be linked by speech paths to SSPs in said switching and transport level, said speech paths being used for transmission of recorded announcements, voice prompts, or the like.

Service networks for the provision of:

- billing;

- maintenance and repair; and

- administration;

may be linked to said data transmission network and may be thereby adapted for two way communication with:

- switching entities in said switching and transport level;

- functional entities in said service execution level; and

- service control points in said service switching level.

Signalling data may be transmitted over links between said gateway means and switching entities in said switching and transport level and SCPs in said service switching level by means of a version of CCITT signalling No. 7, modified for use with INs.

Said switching and transport level may be adapted to carry subscriber traffic including, but not limited to, data, speech, video and facsimile.

Said telecommunications system may include at least a SCP, a SDP, and a plurality of IPs, and telecommunications services and service profiles, provided to subscribers to said telecommunications system, may be assembled from a plurality of service components, at least some of which are located in different ones of said plurality of IPs.

Some of said plurality of service components, required for a telecommunications service and/or service profile, may be located in, and obtainable from, said service control point.

Said telecommunications system may include more than one SCP.

At least some services provided by said telecommunications system may be generated by cooperation between:

- at least two IPs; or

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- one, or more IPs and one, or more SCPs; or

- at least two SCPs.

At least some services, provided by said telecommunications system, may be built from service components held on one, or more, IPs and/or SCPs.

Some of said service components may be services in their own right.

Said service components may include:

- automatic registration on GSM telephones;

- direct connection to customer control from predefined numbers;

- registration, with respect to A-numbers, on the telephone from which a call is made;

- voice mailbox functions;

- price and number plan;

- account call functionality;

- credit limits;

- blockings;

- cost warnings;

- customer control;

- change of price;

- customer controlled debiting;

- once-for-all price;

- "hot billing";

- statistics; and

- geographic and time control.

Each of said plurality of IPs and said at least one SCP may have independent access to said SDP.

There may be provided at least one SDP linked to a telecommunications information system having a central data base holding data on operational aspects of said telecommunications system and subscribers connected thereto, and service network data broker means are provided to handle data requests from said service data point to said central data base and data supplied from said central data base to said service data point.

Said central data base may be able to access data held on at least one data base external to said telecommunications system.

Said at least one external data base may include a telebanking and/or credit card database.

Said central data base may be adapted to supply data to, and receive data from, a plurality of service management functions.

Said plurality of service management functions may include subscriber location services for mobile telephony, paging services and personal number services.

Said central data base may be adapted to supply data to, and receive data

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from, a plurality of management functions.

Said plurality of management functions may include billing functions and, repair and maintenance functions.

Data communications between said service management functions, or said management functions, and said central data base may be effected by a LAN and data broker means.

According to a second aspect of the present invention there is provided, in a telecommunications system including at least a SCP, a SDP, and a plurality of IPs, a method of providing telecommunications services characterised by building telecommunications services and service profiles, to a subscriber's specification, or other specification, from a plurality of service components, at least some of which are located in different ones of said plurality of IPs.

Some of said plurality of service components may be located in said service control point.

Telecommunications services may be provided through cooperation between:

     –     at least two IPs; or

     –     one, or more, IPs and one, or more, SCPs; or

     –     at least two SCPs.

Telecommunications services may be built from service components held on one, or more, IPs and/or SCPs.

Some of said service components may be services in their own right.

Said plurality of service components may include:

- automatic registration on GSM telephones;

- direct connection to customer control from predefined numbers;

- registration, with respect to A-numbers, on the telephone from which a call is made;

- voice mailbox functions;

- price and number plan;

- account call functionality;

- credit limits;

- blockings;

- cost warnings;

- customer control;

- change of price;

- customer controlled debiting;

- once-for-all price;

- "hot billing";

- statistics; and

- geographic and time control.

According to a third aspect of the present invention, there is provided a

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telecommunications information system, including a SDP, for use with a telecommunications system as set forth in any preceding paragraph, characterised in that said SDP is adapted to be linked to a central data base holding data on operational aspects of said telecommunications system and subscribers connected thereto, and in that data requests from said service data point to said central data base and data supplied from said central data base to said service data point are transmitted via service network data broker means.

Said central data base may be able to access data held on at least one data base external to said telecommunications information system.

Said at least one external data base may include a telebanking and/or credit card database.

Said central data base may be adapted to supply data to, and receive data from, a plurality of service management functions.

Said plurality of service management functions may include subscriber location services for mobile telephony, paging services and personal number services.

Said central data base may be adapted to supply data to, and receive data from, a plurality of management functions.

Said plurality of management functions may include billing functions and, repair and maintenance functions.

Data communications between said service management functions, or said management functions, and said central data base may be effected by a LAN and data broker means.

Embodiments of the invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 illustrates, in block schematic form, a known intelligent network architecture.

Figure 2 illustrates, in block schematic form, an intelligent network architecture according to the present invention.

Figure 3 illustrates, in block schematic form, an interface arrangement between an intelligent network and an information system, according to the present invention.

Figure 4 illustrates, in block schematic form, a service architecture for an intelligent network according to the present invention.

To facilitate an understanding of the present invention, a glossary of some of the abbreviations used in the context of intelligent networks is set out below:

AP:             Application Process

ATM:            Asynchronous Transfer Mode

BGS:            An element of a digital exchange, e.g. Ericsson AXE digital
                electronic exchange.

BISDN:          Broad Band Integrated Services Network

CLNP:           Connection-Less Network Protocol (ISO)

CNM:            Customer Network Management

CONP:           Connection-Oriented Protocol (ISO)

CONS:           Connection-Oriented Network Service

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| CORBA: | Common Object Request Broker Architecture |
| --- | --- |
| CP: | Connection Point |
| CPU: | Central Processing Unit |
| DCE: | Distributed Computing Environment |
| DHCP: | Internet Dynamic Host Configuration Protocol |
| DL: | Data-link layer |
| DSM-CC: | Digital Storage Media - Command and Control |
| DXI: | Data Exchange Interface |
| GW: | Gateway |
| IISG: | Interactive Internetwork Systems Generator |
| IN: | Intelligent Network |
| INAP: | Intelligent Network Applications Protocol |
| IP: | Interface Protocol, for the Internet |
| IP: | Intelligent Peripheral |
| ISO: | International Standards Organisation |
| ISUP: | ISDN User Part |
| ITU: | International Telecommunications Union |

LAN:        Local Area Network

LX:         Local Exchange

MD:         Mediation Device

MF:         Management Function

MSC:        Mobile Switching Centre

OAM:        Operations Administration and Maintenance

PABX:       Private Automatic Branch Exchange

PGF:        Product Common Function

PSTN:       Public Switched Telephone Network

RPC:        Routing Preceding Call

SCF:        Service Control Function

SCP:        Service Control Point

SDF:        Specialised Database Function

SDH:        Synchronous Digital Hierarchy

SDN:        Synchronous Digital Network

SDP:        Service Data Point

SIB:        Service Independent Building Block

SLEE: Service Logic Execution Environment

SLP: Service Logic Program

SMAS: Service Management and Administration Service

SMF: Service Management Function

SMS: Service Management System

SMP: Service Management Point

SN: Service Node

SRF: Specialised Resource Function

SPC: Stored Program Control

SS7: CCITT Signalling System No. 7

SSF: Service Control Function

SSP: Service Switching Point

STM: Synchronous Transfer Mode

SUS: An element of digital exchange, e.g. Ericsson AXE digital electronic exchange, which may contain "Plus" services.

TCP: Transmission Control Protocol

TDMA: Time Division Multiple Access

TMN: Specialised Database Function

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TP:         Transport Protocol

TX:         Trunk Exchange

UNIX:       A computer operating system

WWW:        World Wide Web

Turning now to Figure 1, which illustrates a known generic IN architecture, there is shown a number of SSPs located in local, or trunk exchanges. Services are provided by intelligent peripherals (IP), which are linked to, and shared between, the SSPs. The provision of services is controlled by SCPs which can access data held on service data points, SDPs, required for the provision of services by the IPs. Where a number of SCPs are used, a service management systems, SMS, may be provided to integrate and control the operations of the SCPs. The SMS is linked to the SCPs by an X25 data link and the SCPs communicate with the IPs via a signalling network using a modified version of CCITT signalling No. 7. This system is hierarchical in structure and does not provided for speech links between IPs and subscribers.

The architecture of the present invention will now be described with reference to Figure 2. The network operates at three levels, namely:

-.          a service execution level;

-           a service switching level; and

-           a switching and transport level.

The service execution level is concerned with the assembly, operation, administration and execution of telecommunications services provided to subscribers to the telecommunications system. This level includes a data transport network enabling a range of functional units employed in the provision of telecommunications services to communicate with each other. Data transport may

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be effected over one, or more LANs, which may use transmission protocols such as SDH, or ATM. The individual LANs of this network may be interconnected by means of ATM links. The two LANs shown in Figure 2 may employ ATM in conjunction with RPC and TCP/IP, i.e. a transmission control protocol based on the Internet Protocol. Typically, the functional entities connected to the service execution level data transport network may include:

- Internet servers, i.e. a server which provides access to the Internet;

- service control points;

- other service networks, e.g. billing, maintenance and administration networks;

- service data points, which contain detailed information relating to subscribers and the networks, which may in turn be linked to major central databases, and which may include such facilities as home location registers and visiting subscriber registers;

- Internet support systems, i.e. systems designed to facilitate access by subscribers to the Internet and WWW; and

- intelligent peripherals, IP, which are the functional devices which provide telecommunications services.

The service switching level provides the interface between the service execution level and the switching and transport level. This level of the system ensures that access is provided between the SSPs of the switching and transport level and the service functions of the service execution level. In particular, the service switching level ensures that the resources required by an SSP to provide a given service to a subscriber are available to that SSP. The service switching level includes at least one service control point which, may, or may not, be accessed for the provision of a given service to a subscriber. The links between the service execution level and the service control point located in the service switching

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level may be provided by an intelligent network applications protocol operating with CCITT signalling No.7, appropriately modified for use in IN, and employ a suitable gateway, or mediation unit, MD/GW. Alternatively, a direct link may be provided using an intelligent network applications protocol in conjunction with a suitable transport control protocol such as the internet protocol.

Direct links, across the service switching level may be provided between the service execution level and the switching and transport level, by-passing the service control point located in the service switching level. Such links are provided by means of gateway, or mediation units, MD/GW and use intelligent network applications protocols in conjunction with CCITT signalling No. 7. It should be noted that direct speech paths may be provided between IPs and SSPs to facilitate the provision of, for example, voice prompt driven services.

The switching and transport level of the system is the conventional traffic bearing telecommunications system which carries customer traffic. Such traffic may include data, speech, video and facsimile. The SSPs of the switching and transport level may included Internet SSPs, ATM SSPs, exchange based SSPs, such as SUS and BUGS (Ericsson AXE digital exchanges) and other types of SSP.

Referring now to Figure 3, there is shown a central data base, labelled "operator's information base". This data base holds substantial amounts of data relating to the telecommunications operator's system/network, including records of the prevailing system and service configuration, maintenance and repair information, data on all subscribers connected to the system and the quality of service to which they are entitled etc..

The central data base may be operationally linked to one, or more, external data bases, from which it is able to extract additional data relevant to the operation of the telecommunications system and/or the provision of telecommunications services over the system. For example, telecommunications services now provide for the electronic transfer of funds, so the external data base might be a data base operated by a credit card company, or other financial institution, e.g. VISA. The link between the central data base and external data bases may be via the medium of

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the service network data broker.

The service network associated with a telecommunications system is that element of the telecommunications system responsible for the provision of telecommunications services to subscribers. The service network may be an intelligent network. Service provision and execution, especially for advanced services and service profiles, requires the supply of substantial amounts of data relating to the telecommunications network and the subscribers connected thereto. This data must be accurate and current. It is thus of considerable importance that the service data points in an intelligent network, used for the provision and execution of advanced services, have access to accurate and current data. In the present invention, the service data points of an IN can transmit data requests to the central data base and receive data therefrom, in response to such requests, via a service network data broker. It should be remembered that the central data base must cope with data requests from many SDPs on a continuous basis. For this reason, the use of a service network data broker is seen as being a substantial advantage.

Data may also be passed in the reverse direction, i.e. from service data points to the central data base. Changes to the network configuration, or service requirements of a subscriber, may first be recorded by a service data point.

The central data base not only supports service provision and execution, but also supports a range of service management functions and network management functions, designated SMF and MF respectively in Figure 3. Management functions may include billing services, administration services, repair services and maintenance services. Service management functions may include subscriber locations services, for example, for mobile telecommunications, paging services and personal number services. Information may be exchanged between the central data base and the service management functions and management functions of the network via the medium of a management broker. The management broker may include LAN servers, CSMP, and LANs linking the central data base to the various management and service management function nodes of the network.

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Turning now to Figure 4, there is shown the service execution level of an intelligent network, according to the present invention. Each of the two IPs shown in Figure 4 carries different service components required by a given service profile, service 2. When this service profile is made available to a subscriber, both IPs are required to cooperate in the execution of the service. It should be noted that service related data can be accessed from the SDP by both IPs.

In a second service execution configuration, service 1, provision of the service requires cooperation of both the SCPs illustrated in Figure 1, together with one of the IPs. In other words, the SCPs may hold certain service components. Both the SCPs and the IP involved in the provision of this service profile, service 1, can access service dependent data held on the SDP.

The service architecture herein described is aimed at achieving:

- more efficient service development - by service components which are used in a number of products, i.e. for product common functions;

- development of new types of services, for example, with data communications and customer equipment;

- support for customer adaption (packaging) of "standardised" services;

- controlled development of the service platforms and support for a number of suppliers;

- distribution of service components on different nodes in the platforms, for optimal utilisation of nodes; and

- conditions for integration of service platforms, fixed and mobile.

The service platform in the network is primarily provided by an IN. IN, as it

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is defined today, must overcome the problems caused when the range of services and the number of customers increases. An important restriction with existing IN systems is the use of "single point of control", i.e. an SCP is located, like a spider, at the centre of a web and controls all resources (for instance, SDPs and IPs) which are used to implement the service. IN originates from a standard in which it was assumed that all telecommunications services were standardised. Because of the demands of competition and customer requirements, services must be provided in many different formats and packaged to meet the needs of different market sectors.

In order to rapidly and efficiently create new services, especially integrated services, it is necessary to utilise the components of existing services. This, among other things, implies that a number of SCPs will be involved in a single service. It is also desirable to be able to implement a service component in the most suitable network node, for example, by moving logic from one SCP to another. This has consequences for the cooperation between different network nodes in terms of protocols and interfaces and the distribution of functions and data between different nodes.

This distribution and cooperation also affects support systems, when new services and customers are added to the network, for example, billing is effected. Any proposal for a new service architecture and/or service platform must, therefore, include interfaces with support and administration systems and provide for inter-operation therewith.

A number of services will be offered by fixed and mobile access routes. This means that service platforms must be constructed in accordance with a common service architecture and must have a well defined inter-operability.

A (common) service architecture creates a base for a service platform strategy and a common relationship with suppliers.

The concepts embodied in the present invention illustrate a number of features:

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- service components in the form of product common functions;

- architecture for service components; and

- modifications to the IN platform

Today's IN is, according to IN standards, defined by the editions CS1, CS2, etc; it includes the following concepts:

- SCF, SSF, SDF and SRF for functional nodes;

- SSP, SCP, SDP and IP for implemented nodes; and

- Core INAP as interface and protocol.

The IN standard is not integrated with the TMN-standard; for this reason the integration of networks and support systems in the service platform is poorly supported. At the same, time IN-standards are not well adapted to handle developments in the field of computing and data communication. Suppliers with UNIX-based solutions often utilise the standards from the DP sector in the operation and maintenance of IN-nodes

IN has emerged as a superstructure to the "basic call" of telephony, which can be regarded as a sub-routine call from the main switching train to IN. After the necessary "calculations" are performed, the main switching train continues, based on new date. IN has a strongly function-oriented approach. Connection and signalling is made step-by-step, i.e. necessary network resources are allocated gradually. The base for control is in SCP in a single "point of control". In the new distributed concepts, such as ODP, TINA and CORBA, there is better control over existing resources when the switching train starts.

The long term development, within IN, is towards TINA and COBRA and similar architectures. However, it will take time, i.e. 3 to 5 years, before products with the same functionality and performance, as that of today's IN, will emerge.

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The service platform is regarded as a wider concept than the IN-platform since it includes stand alone "boxes" which are connected in ways other than by IN's standardised protocols.

Today's IN-platform in the fixed network is actually a service platform in the sense that it mixes IN and stand alone service nodes which are connected either via P7/P8, or SS7 (ITUP, NTUP, ISUP).

The applicant's service network today consists of SCP from Ericsson SSI 2.1. In the applicant's network there are SSPs in two trunk exchanges and 4 pairs of SCPs. AST-DR connected to an SSP is utilised for voice output. Other services are offered via "service-boxes", here referred to as SSNs (stand-alone service nodes). Today the VMIS voice platform (Bull) for the applicant's Telesvar, Teligent for faxbox and Access Line for Persona (today via P7/P8, later ISUP) is in the process of installation. SSI2 is connected to the support systems via SMAS which also functions as a service creation and unifying link for standby. In some services a GW (KODEX) made by the applicant is used to connect the SMAS to the customer administration systems.

The applicant's Mobitel service platform currently consists of a stand alone SSP. In the future, the SSP will be contained in an MSC so there will be no need for a stand alone SSP in the provision of mobile services. The Mobitel service platform is dominated by VMIS, which is used for Mobilsvar. Atlas is used as a fax box. Both these are stand alone service nodes connected to SS7. A SCP (IN2.1) has recently been installed in Mobitel Direkt.

The connection of the support systems (CCBARB) to SMAS is made via GW (INAS).

IN has a strongly function oriented approach where data has the quality of an additional aspect. This means that each service has a strong connection between the service and customer data.

Today, customers want to keep all their services together so that they can

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make changes to their total service profile, and collect and arrange billing in new and different ways, i.e. have a better total control. The quantity of data which an IN system must handle, can be expected to increase dramatically because of the need to adapt to customer requirements. This means that in all systems, from the network level to customer administration systems, data/service profiles for a given customer must be kept together. The service platform must, therefore, be more data oriented.

Separate nodes, (SCP and SDP), in modern IN systems require that the script used in SCPs must perform a large number of data base operations in relation to SDPs, especially if there is a lot of customer unique data used in the provision of a service. This creates substantial protocol traffic between nodes. In order to reduce unnecessary traffic between nodes, the intelligence in nodes, such as SDP and IP nodes, can be increased.

Protocols, such as INAP, require substantial execution capacity. These standards only evolve slowly within the telecommunications standards sector and among telecommunications suppliers. At the same time, the computer and data processing sectors offer protocols with broadband transport capability which are well adapted to the needs of telecommunications and which develop substantially faster than the standardised telecommunications protocols.

New services will include functions, such as "hot billing", which demand better integration between service platforms in the network and support systems. These developments are supported by the use of UNIX. In the long run, concepts such as TINA-C and CORBA will offer that support. TINA-C has a totally integrated approach to network and support.

The network architecture to which the present invention relates can be described as a level-oriented architecture. This architecture is aimed at increasing the separate identities of different aspects of the service platform and thereby facilitating service development independently of the physical structure of the service platform. This, in turn, facilitates the packaging of services and the creation of services from service components and the redistribution of service components

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on other physical platforms.

To realise this architecture, it is necessary to identify service components and product common functions (PGF), and to create an application architecture which includes packeting of, and communication between, components.

In many service/product functions both small modules, such as geographic and time control, and large modules, such as voice mail box, are used repeatedly in different service profiles. This is the case for both the fixed network and mobile networks, as well as for services which span both the fixed and mobile networks. This can result in lower efficiency development and, more seriously, differences in the subscriber-network interface.

The system to which the present invention relates permits the use of small and large service components and the construction, where appropriate, of larger service components from smaller components.

Some examples of service components are set out below:

- automatic registration on GSM telephones;

- direct connection to customer control from predefined numbers;

- registration, with respect to A-numbers, on the telephone from which a call is made;

- voice mailbox functions;

- price and number plan;

- account call functionality;

- credit limits;

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-    blockings;

-    cost warnings;

-    customer control;

-    change of price;

-    customer controlled debiting;

-    once-for-all price;

-    "hot billing";

-    statistics; and

-    geographic and time control.


Characteristics of these service components are that they may:

-    include product common functions (PGF);

-    be packeted (documented) according to certain rules/internal standards; and

-    communicate with each other by means of internal standards

A service component may be allocated to any node and may be a "Plus" service.

The packeting of PGF and other functions in a service component architecture means that it must be possible to describe for each service component's:

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-     functions and data; and

-     interfaces, for both operations and data, towards other service
      components.

As container protocols between applications, except SSP - SCP, RPC may
be preferred. RPC is usually used between computers employing UNIX as an
operating system. However, a number of variations are possible, for example,
DCE-RPC and SUN-RPC. In order to make communications function over different
types of RPC, an internal standard must be specified.

On the other hand, it is noted that Ericsson's AXE-based SCP does not offer
RPC. For this, a gateway/mediation device, or other modification of the SSI-
platform, is required.

The service platform, to which the present invention relates, is considerably
more integrated than current service platforms, in a number of respects, for
example:

-     the service platform can be used for services based on both the
      fixed and mobile networks;

-     stand alone "boxes" are integrated in service nodes and IPs; and

-     service nodes are directly connected.

The service components used as building blocks for services and service
profiles may be distributed over a number of nodes. This means that more SCPs,
SDPs and IPs etc. are involved in the execution of a service. In fact, the service
platform can be considered as a number of service nodes with different
specialisations.

One characteristic of future service networks is that customer data will be
centred in one, or more, SDPs. An SDP can cooperate with a number of SCPs in

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which are located different services and service components. Today's "boxes" are either IPs, or SNs, which are well integrated into the platform. Furthermore, mobile services are well integrated. Services delivered via ATM and the Internet can also be controlled via the service network. Different types of nodes can be interconnected more flexibly and adapted for different purposes. The support systems are connected via internally standardised interfaces which also make possible connection of external data bases, such as VISA.

In order to link service components together over a number of nodes, RPC on TCP/IP can be used. Alternatively, INAP can be used for data transmissions between SCPs and other nodes, together with conversion to RPC. This may yield internal standardisation and a greater bandwidth than can be achieved with INAP.

In addition to the ability to distribute service components between nodes on the service platform, it is possible to split the service platform into two levels, one level handling the switching of data trains within the service platform and the other level handling the execution of services.

The service network is thus built from different "levels", where SCPs are used for service connection and UNIX-based systems are used to provide more open and flexible service execution than is possible with prior art IN systems. This should encourage competition both in terms of computer hardware and software.

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## CLAIMS

1.      A telecommunications system, having an intelligent network architecture and including at least one service data point, at least one service control point, a plurality of service switching points, and a telecommunications traffic network, characterised in that functional entities, controlling execution of telecommunications services, are linked by a data transmission network, capable of operating independently of said telecommunications traffic network.

2.      A telecommunications system as claimed in claim 1, characterised in that said telecommunications system is arranged in three hierarchical levels, namely:

-        a service execution level;

-        a service switching level; and

-        a switching and transport level.

3.      A telecommunications system as claimed in either previous claim 1, or claim 2, characterised in that said data transmission network includes at least one LAN, to which a plurality of said functional entities are connected.

4.      A telecommunications system as claimed in claim 3, characterised in that said data transmission network includes at least two LANS, to each of which is connected a plurality of functional entities, and in that said at least two LANS are interconnected by means of an ATM link over which data is passed in RCP and TCP/IP format.

5.      A telecommunications system as claimed in either claim 3, or claim 4, characterised in that said LAN(s) and the functional entities connected thereto form a service execution level.

6.      A telecommunications system as claimed in any previous claim, characterised in that said functional entities include one, or more, of the following:

- Internet servers;

- service data points;

- service control points;

- service nodes;

- intelligent peripherals; and

- Internet support systems.

7.    A telecommunications system as claimed in any of claims 2 to 6, characterised in that said switching and transport level includes one, or more, of the following switching entities:

–    a SUS;

–    a SSP;

–    an ATM SSP; and

–    an Internet SSP.

8.    A telecommunications system as claimed in any of claims 2 to 7, characterised in that said service switching level includes one, or more SCPs.

9.    A telecommunications system as claimed in any of claims 6 to 8, characterised in that said service execution layer is connected to said switching and transport level by means of an INAP/TCP/IP link between said data transmission network and an SCP in said service switching level, and in that said SCP in said service switching level is directly linked to switching entities in said switching and transport level.

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10.    A telecommunications system as claimed in any of claims 6 to 9, characterised in that gateway means are provided to link functional entities, including SCPs, in said service execution level, to switching entities in said switching and transport level.

11.    A telecommunications system as claimed in either claim 9, or 10, characterised in that SCPs in said service switching level are linked to functional entities in said service execution level via a gateway means, and are, in addition, linked directly to said data transmission network.

12    A telecommunications system as claimed in any of claims 3 to 11, characterised in that IPs in said service execution level are linked by speech paths to SSPs in said switching and transport level, said speech paths being used for transmission of recorded announcements, voice prompts, or the like.

13.    A telecommunications system as claimed in any of claims 3 to 12, characterised in that service networks for the provision of:

–        billing;

–        maintenance and repair; and

–        administration;

are linked to said data transmission network and are thereby adapted for two way communication with:

–        switching entities in said switching and transport level;

–        functional entities in said service execution level; and

–        service control points in said service switching level.

14.    A telecommunications system as claimed in any of claims 10 to 13,

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characterised in that signalling data is transmitted over links between said gateway means and switching entities in said switching and transport level and SCPs in said service switching level by means of a version of CCITT signalling No. 7, modified for use with INs.

15.    A telecommunications system as claimed in any of claims 2 to 14, characterised in that said switching and transport level is adapted to carry subscriber traffic including, but not limited to, data, speech, video and facsimile.

16.    A telecommunications system as claimed in any previous claim, characterised in that said telecommunications system includes at least a SCP, a SDP, and a plurality of IPs, and in that telecommunications services and service profiles, provided to subscribers to said telecommunications system, can be assembled from a plurality of service components, at least some of which are located in different ones of said plurality of IPs.

17.    A telecommunications system as claimed in claim 16, characterised in that some of said plurality of service components, required for a telecommunications service and/or service profile, may be located in, and obtainable from, said service control point.

18.    A telecommunications system as claimed in either claim 16, or 17, characterised in that said telecommunications system may include more than one SCP.

19.    A telecommunications system as claimed in any of claims 16 to 18, characterised in that at least some services provided by said telecommunications system are generated by cooperation between:

–      at least two IPs; or

–      one, or more IPs and one, or more SCPs; or

–      at least two SCPs.

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20.   A telecommunications system as claimed in any previous claim, characterised in that at least some services, provided by said telecommunications system, are built from service components held on one, or more, IPs and/or SCPs.

21.   A telecommunications system as claimed in claim 20, characterised in that some of said service components are services in their own right.

22.   A telecommunications system as claimed in either claim 20, or 21, characterised in that said service components may include:

-   automatic registration on GSM telephones;

-   direct connection to customer control from predefined numbers;

-   registration, with respect to A-numbers, on the telephone from which a call is made;

-   voice mailbox functions;

-   price and number plan;

-   account call functionality;

-   credit limits;

-   blockings;

-   cost warnings;

-   customer control;

-   change of price;

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-     customer controlled debiting;

-     once-for-all price;

-     "hot billing";

-     statistics; and

-     geographic and time control.

23.    A telecommunications system as claimed in claim 19, characterised in that each of said plurality of IPs and said at least one SCP have independent access to said SDP.

24.    A telecommunications system as claimed in any previous claim, characterised in that there is provided at least on SDP linked to a telecommunications information system having a central data base holding data on operational aspects of said telecommunications system and subscribers connected thereto, and in that service network data broker means are provided for handling data requests from said service data point to said central data base and data supplied from said central data base to said service data point.

25.    A telecommunications system as claimed in claim 24, characterised in that, said central data base can access data held on at least one data base external to said telecommunications system.

26.    A telecommunications system as claimed in claim 25, characterised in that, said at least one external data base includes a telebanking and/or credit card database.

27.    A telecommunications system as claimed in any of claims 24, to 26, characterised in that said central data base is adapted to supply data to, and receive data from, a plurality of service management functions.

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28.    A telecommunications system as claimed in claim 27, characterised in that said plurality of service management functions include subscriber location services for mobile telephony, paging services and personal number services.

29.    A telecommunications system as claimed in any of claims 24 to 28, characterised in that said central data base may be adapted to supply data to, and receive data from, a plurality of management functions.

30.    A telecommunications system as claimed in any of claims 27 to 29, characterised in that said plurality of management functions include billing functions and, repair and maintenance functions.

31.    A telecommunications system as claimed in any of claims 24 to 30, characterised in that data communications between said service management functions, or said management functions, and said central data base are effected by a LAN and data broker means.

32.    In a telecommunications system including at least a SCP, a SDP, and a plurality of IPs, a method of providing telecommunications services characterised by building telecommunications services and service profiles, to a subscriber's specification, or other specification, from a plurality of service components, at least some of which are located in different ones of said plurality of IPs.

33.    A method, as claimed in claim 32, characterised by some of said plurality of service components being located in said service control point.

34.    A method, as claimed in either claim 32 , or claim 33, characterised by providing telecommunications services through cooperation between:

    —    at least two IPs; or

    —    one, or more, IPs and one, or more, SCPs; or

    —    at least two SCPs.

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35.    A method, as claimed in any of claims 32 to 34, characterised by building telecommunications services from service components held on one, or more, IPs and/or SCPs.

36.    A method, as claimed in claim 35, characterised by some of said service components being services in their own right.

37..   A method, as claimed in any of claim 32, to 36, characterised in that said plurality of service components may include:

-    automatic registration on GSM telephones;

-    direct connection to customer control from predefined numbers;

-    registration, with respect to A-numbers, on the telephone from which a call is made;

-    voice mailbox functions;

-    price and number plan;

-    account call functionality;

-    credit limits;

-    blockings;

-    cost warnings;

-    customer control;

-    change of price;

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- customer controlled debiting;

- once-for-all price;

- "hot billing";

- statistics; and

- geographic and time control.

38. A telecommunications information system, including a SDP, for use with a telecommunications system as claimed in any of claims 1 to 31, characterised in that said SDP is adapted to be linked to a central data base holding data on operational aspects of said telecommunications system and subscribers connected thereto, and in that service network data broker means are provided for handling data requests from said service data point to said central data base and data supplied from said central data base to said service data point.

39. A telecommunications information system as claimed in claim 39, characterised in that, said central data base can access data held on at least one data base external to said telecommunications information system.

40. A telecommunications information system as claimed in claim 40, characterised in that, said at least one external data base includes a telebanking and/or credit card database.

41. A telecommunications information system as claimed in any of claims 39, to 41, characterised in that said central data base is adapted to supply data to, and receive data from, a plurality of service management functions.

42. A telecommunications information system as claimed in claim 42, characterised in that said plurality of service management functions include subscriber location services for mobile telephony, paging services and personal number services.

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43.   A telecommunications information system as claimed in any of claims 39 to 43, characterised in that said central data base may be adapted to supply data to, and receive data from, a plurality of management functions.
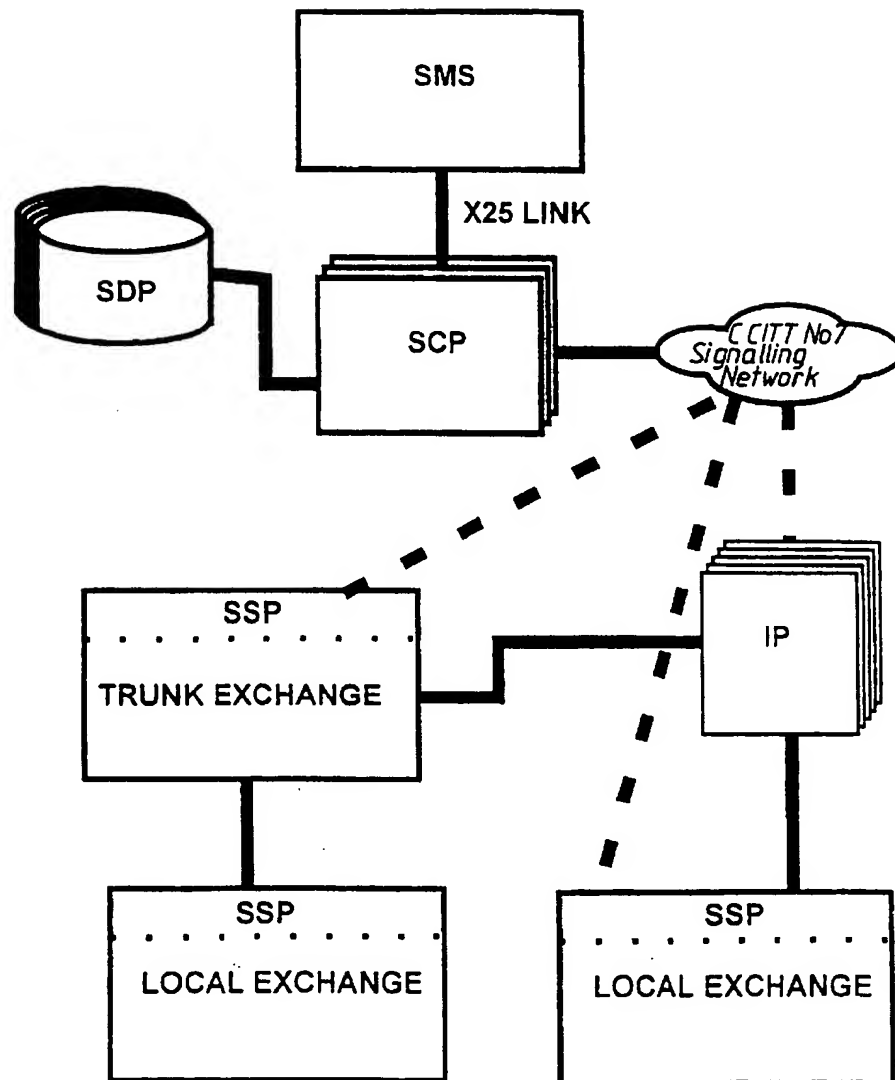
44.   A telecommunications information system as claimed in any of claims 39 to 44, characterised in that said plurality of management functions include billing functions and, repair and maintenance functions.

45.   A telecommunications information system as claimed in any of claims 39 to 44, characterised in that data communications between said service management functions, or said management functions, and said central data base are effected by a LAN and data broker means.
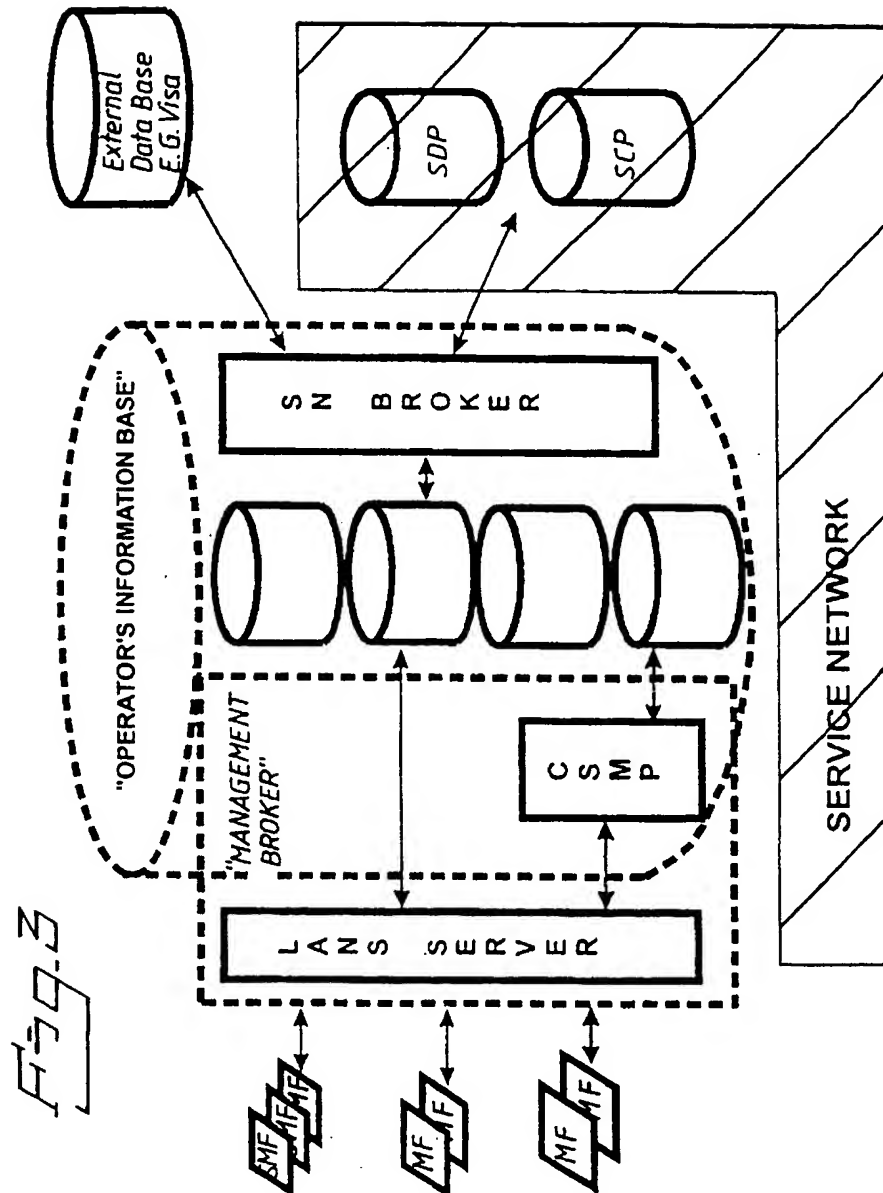
**SUBSTITUTE SHEET**
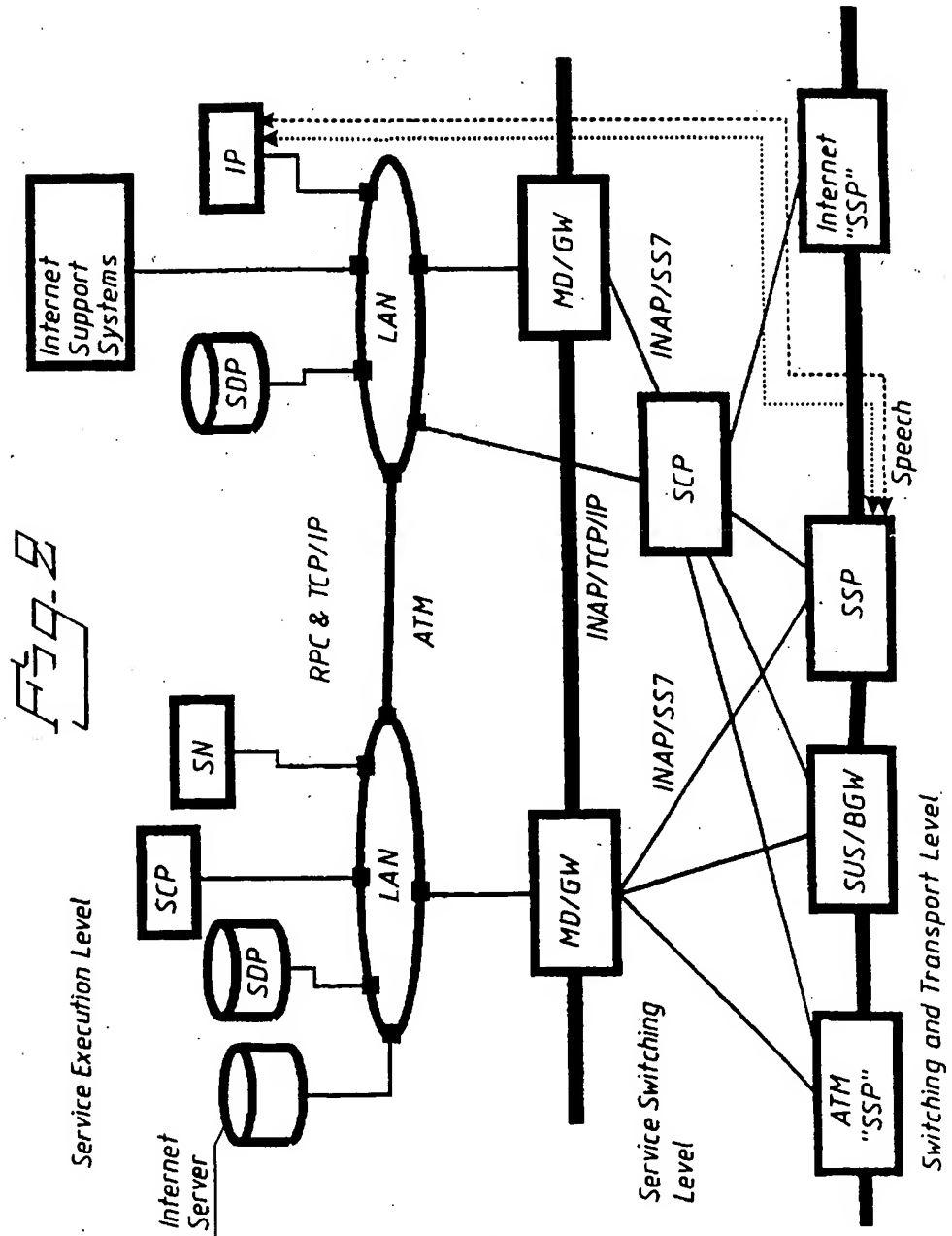
*Fig.1*



SMS

X25 LINK

SDP
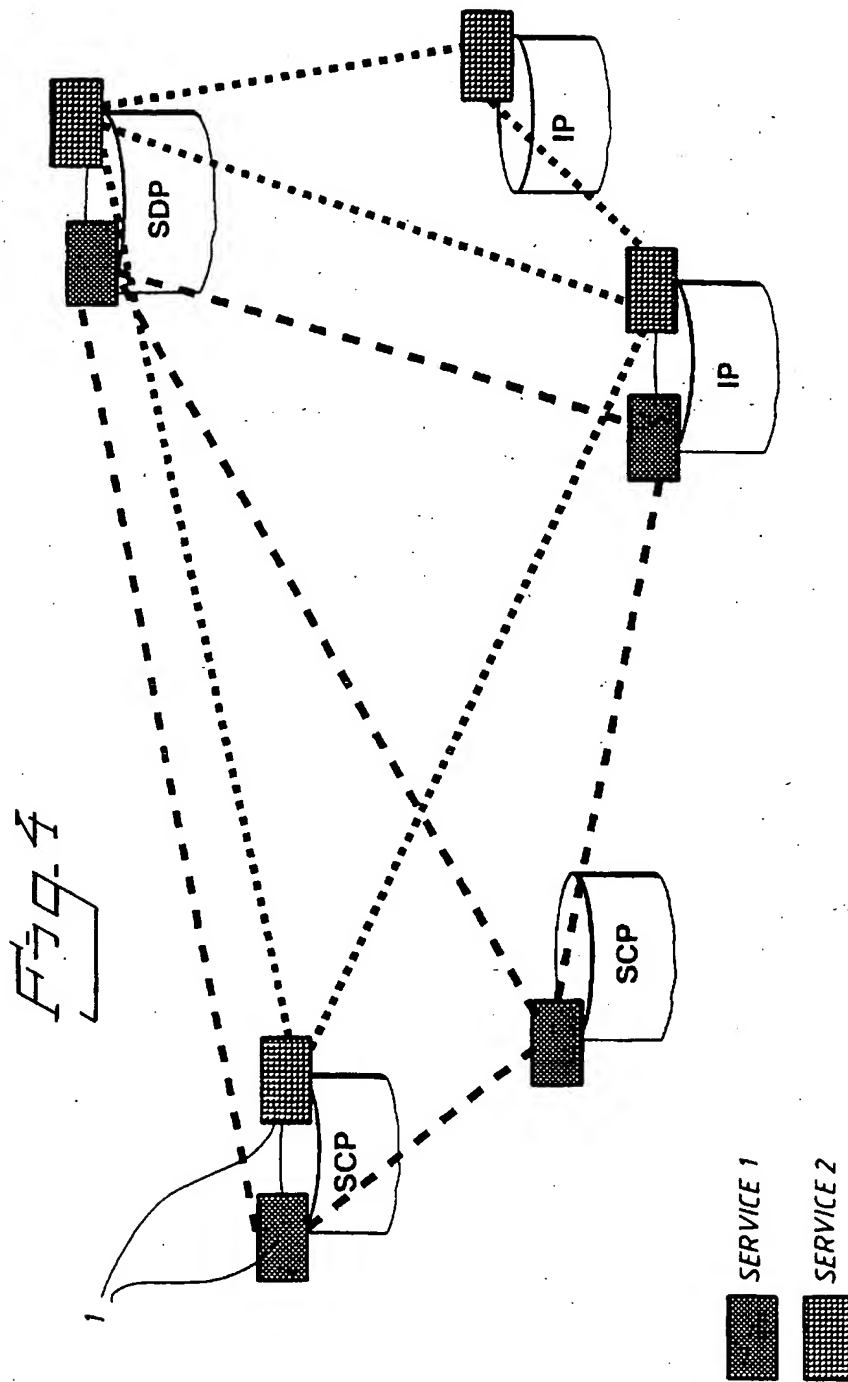
SCP

C CITT No7
Signalling
Network

SSP

TRUNK EXCHANGE

IP

SSP

LOCAL EXCHANGE

SSP

LOCAL EXCHANGE

**SUBSTITUTE SHEET**

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Fig. 2

Fig. 3

Fig. 4

SDP

IP

IP

SCP

SCP

SERVICE 1

SERVICE 2

**SUBSTITUTE SHEET**

# INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 97/00658

## A. CLASSIFICATION OF SUBJECT MATTER

IPC6: H04Q 3/00, H04M 3/42
According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: H04Q, H04M, H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X | US 5469500 A (SOHAIL SATTER ET AL), 21 November 1995 (21.11.95), column 8, line 21 - column 11, line 65, figures 3,4 | 1-3,5-24,38 |
| Y | | 32-37 |
| A | | 4,25-31, 39-45 |
| | --- | |
| Y | WO 9604756 A1 (BRITISH TELECOMMUNICATIONS PUBLIC LIMITED COMPANY), 15 February 1996 (15.02.96), page 5, line 5 - page 7, line 12, figure 2 | 32-37 |
| | --- | |

☐ Further documents are listed in the continuation of Box C.    ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"B" earlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 28 August 1997 | 0 3 -09- 1997 |
| Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86 | Authorized officer Göran Magnusson Telephone No. +46 8 782 25 00 |

Form PCT/ISA/210 (second sheet) (July 1992)

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 97/00658

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**Box I     Observations where certain claims were found unsearchable (Continuation of Item 1 of first sheet)**

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐  Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐  Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐  Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

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**Box II     Observations where unity of invention is lacking (Continuation of Item 2 of first sheet)**

This International Searching Authority found multiple inventions in this international application, as follows:

see next page

1. ☐  As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☒  As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐  As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐  No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

**Remark on Protest**       ☐  The additional search fees were accompanied by the applicant's protest.

☐  No protest accompanied the payment of additional search fees.

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Form PCT/ISA/210 (continuation of first sheet (1)) (July 1992)

I. Claims 1-31 refer to an intelligent network architecture.

II. Claim 32-45 refer to a method of building telecommunications services from a plurality of service components.

These groups of inventions are not so linked as to form a single general inventive concept (PCT Rule 13.1). There is no technical relationship among those inventions involving one or more of the same or corresponding "technical features" within the meaning of PCT Rule 13.2 (the contribution which the invention, considered as a whole, makes over the prior art) . The special technical feature of claim 1 is that functional entities controlling execution of telecommunications services are linked by a data transmission network capable of operating independently of the telecommunication traffic network, while the special technical feature of claim 32 is that at least some of the service components are located in different IPs.

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---|---|---|
| US 5469500 A | 21/11/95 | US 5572581 A<br>US 5644631 A | 05/11/96<br>01/07/97 |
| WO 9604756 A1 | 15/02/96 | AU 3182895 A<br>EP 0774196 A<br>FI 970384 A<br>NO 970438 A | 04/03/96<br>21/05/97<br>30/01/97<br>31/01/97 |

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